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EXAMINER	
SYKES, ALTREV C	

ART UNIT	PAPER NUMBER
4145	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/516,322	HENRICH ET AL.	
	Examiner	Art Unit	
	AITrev C. Sykes	4145	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 December 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20050228*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: Tailored Fiber Placement technology is referred to as TFP technology and TOP technology. (See pg1, lines 24-25 and pg7, lines 22-23)
Appropriate correction is required.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the preform 48 as recited in claims 1, 4, 9-12, 17, 19-22, and 24 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.
Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining

figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: reference 18 in Fig. 1. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claim 7 is objected to because of the following informalities: It is unclear what the applicant is describing with the term "1391".

Appropriate correction is required.

5. Claim 7 is objected to because of the following informalities: Each claim should begin with a capital letter and end with a period.

Appropriate correction is required.

6. Claim 20 is objected to because of the following informalities: No claim identifier is present. Appropriate correction is required.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention

Regarding claim 1, the phrase "in particular" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Regarding claim 2, the phrase "e.g." renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Regarding claim 16, the limitation "the reinforcing fibers extend in a layer extending from their central opening tangentially thereof" renders the claim

indefinite because it is unclear from where or from what the central opening extends. See MPEP § 2173.05(d).

Regarding claim 17, the limitation "the reinforcing fibers are placed in such a way that the pyrolyzed preform corresponds, or substantially corresponds, in its radial measurement to that of the preform" renders the claim indefinite because only one type of preform is recited in claim 1. It is unclear how an unclaimed pyrolyzed preform corresponds in its radial measurement to that of the claimed preform. See MPEP § 2173.05(d).

Claim 23 recites the limitation "the preforms are stitched together with the base layer". There is insufficient antecedent basis for this limitation in the claim because the claim is dependent upon claim 1 which does not recite a base layer. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 1-8, 10-12, 17-18, 20, and 25-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krenkel et al (US 6,042,935) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement)

Regarding claim 1, Krenkel et al. discloses:

- a tribological fiber composite component (See "three-dimensional fiber" in Col 4, lines 10-14)
- in the form of a brake or clutch disk (See Fig.1A and Col 1, lines 4-9)
- employing a structure with at least one preform (See ref. 2 in Fig. 2, refs. 1 and 2 in Fig. 3, and ref. 2 in Fig. 6)

having at least one stressable reinforcing fiber layer, (See Col 4, lines 14-16 and Col 4, lines 39-49)

- the structure being stabilized by material deposition from the gas phase and/or provided with a monomer and/or polymer, hardened and pyrolyzed. (See Col 5, lines 9-16, wherein silicon is infiltrated into the pores to form a silicon carbide protective layer.)

Regarding claim 1, while Krenkel discloses at least one preform (i.e. layer) having at least one stressable reinforcing fiber layer made of carbon fiber reinforced fibers, (Col 1, lines 4-9) the reference does not disclose said preform being a TFP preform.

Mattheij et al. teaches a preform made of carbon reinforced fibers wherein said preform is a TFP preform (See pg 571). This TFP preform is disclosed as resulting in a great variety of textile structures with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), and deep-drawable preforms. Additionally, these TFP preforms allow for processing of natural, glass, aramid, carbon and ceramic fibers which provides for maximum exploitation of reinforcing fibers through uniformly stressed fibers in the composite and near-net-shape production (no cutting, low waste). (See Sect. I., pg. 571) Further the production costs are lowered because of the use of rovings and the high degree of automation. (See Sect. I., pg. 571)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to produce at least the preform used as the friction body

of Krenkel et al. with the TFP process as taught by Mattheij, for the purpose of producing a preform with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), or deep-drawable preforms all of which are capable of lower production costs thereby obtaining a woven preform of complex shape having improved torsional and shear properties.

As claim 1 is a product-by-process claim, patentability of said claim is based on the recited product and does not depend on its method of production. Since the product in claim 1 is the same as the product disclosed by modified Krenkel et al. in view of Mattheij et al. the claim is unpatentable even though the product of modified Krenkel et al. was made by a different process. In re Marosi, 710 F2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). See MPEP 2113.

Regarding claim 2, 3, and 17 modified Krenkel et al. discloses all of the claim limitations as set forth above.

Additionally, Krenkel et al. discloses the fiber composite component characterized in that:

- the structure is stabilized, in particular, by CVI deposition with e.g. C, SiC, B4C and/or Si. (See Col 3, lines 5-7 and Col 5, lines 9-16)
- the structure is siliconized after the pyrolysis. (See Col 3, lines 5-7 and Col 5, lines 9-16)
- in a circular preform the reinforcing fibers are placed in such a way that the pyrolyzed preform corresponds, or substantially corresponds, in its radial measurement to that of the preform. (See Fig. 1)

As claim 2, 3, and 17 are a product-by-process claim, patentability of said claim is based on the recited product and does not depend on its method of production. Since the product in claim 2 is the same as the product disclosed by modified Krenkel et al. in view of Mattheij et al. the claim is unpatentable even though the product of modified Krenkel et al. was made by a different process. In re Marosi, 710 F2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). See MPEP 2113.

Regarding claims 4-8, 10-12, 18, 20, and 25-29 modified Krenkel discloses all of the claim limitations as set forth above.

Additionally, Krenkel discloses the fiber composite component characterized in that:

- the at least one preform consists of areas or layers which differ from one another in their fiber volumes and/or their layer density and/or their fiber lengths and/or their fiber placement direction. (See Col 4, lines 43-49)
- the structure has at least two preforms which are preferably constructed the same or essentially the same. (See ref. 2, Fig. 3 & 6, and Col 3, lines 50-60)
- the structure has recesses and/or channels optionally provided with cores. (See Figs. 2 & 6)
- the fiber composite compound comprises a composite of at least one preform (See Fig. 3, refs. 1 & 2) and a layer and/or fabric and/or short fibers and/or felt and/or fleece, 1391 (See Fig. 3, ref. 5)

- the preform is provided with a layer of short fibers on the outside. (See ref. 2, Fig. 3 and Col 4, lines 47-50, wherein 1-10 mm are short fibers)
- the preform has reinforcing fibers in the form of roving strands or fiber bands. (Col 5, lines 13-16 wherein fiber clusters read on fiber bands and roving strands)
- the preform has reinforcing fibers in the form of natural, glass, aramide, carbon and/or ceramic fibers. (See Col 4, lines 7-13, and 40-43)
- the preform consists of several layers of placed reinforcing fibers, the direction of placement of the reinforcing fibers varying from one another in successive layers. (See Col 4, lines 43-49)
- the reinforcing fibers are stitched together with polymer fibers and/or carbon fibers. (See carbon sewing threads in Col 4, lines 10-14)
- the structure of a clutch disk comprises at least two preforms having the same, or essentially the same, structure. (See Figure 3, ref. 2 and Col 3, lines 50-60)
- the structure of a brake disk consists of at least two preforms (See Fig. 6, ref. 2) spaced from one another and which are connected to one another by webs formed from reinforcing fibers (See Fig. 6, ref. 25)
- the preform has a thickening formed by reinforcing fibers in the region of a force input point. (See Col 4, lines 7-14, wherein sewing would provide

force input points for the stacked layers thereby, inherently, forming a thickening of the reinforcing fibers)

- the reinforcing fibers are placed so as to cross one another in the thickening. (See Col 4, lines 40-46, wherein orientation of the fibers can be different, oriented or unoriented in the entire preform including the thickening formed by the force input point)
- the reinforcing fibers are placed so as to cross one another in the webs. (See Col 4, lines 40-46, in the entire preform forming the core body)
- the preform has a fleece layer on its free outer surfaces. (See ref. 5, Fig. 3, wherein the fleece layer is on the outer surface of the core body)

13. Claims 13-16, 21, 22, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krenkel et al (US 6,042,935) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) as applied to claims 1-8, 10-12, 17-18, 20, and 25-29 above and further in view of Bilisik. (US 6,129,122)

Regarding claims 13-16, 21, 22, and 24 modified Krenkel discloses all of the claim limitations as set forth above. Additionally, Mattheij et al. teaches the process of using the tailored fiber technique based upon the embroidery technique and zigzag stitching (See p. 571, Introduction) to produce the friction preform, but it does not explicitly disclose the detailed orientation of the fiber preform resulting from using said stitching process. Specifically, it does not

disclose the reinforcing fibers extending radially in a layer, extending in a circular manner in a layer, extending involutely in a layer, extending from their central opening tangentially, or fibers being placed symmetrically or substantially symmetrically with respect to the central symmetrical plane of the preform in their fiber orientation. Further, Mattheij et al. does not disclose the preform consisting of at least two layers, one of the layers being built from radially placed reinforcing fibers and the remaining layer of reinforcing fibers placed in a circular manner and the preform has fibers of the same or essentially the same orientation in its outer surfaces.

Bilisik discloses a three-dimensional multiaxial circular woven fabric for use as a preform that can be constructed with fiber content in each direction of the preform that is tailored to correspond to the required properties of the preform using a technique that is either the same or equivalent to that of the TFP preform of Mattheij et al. (See Col 2, lines 23-28) The three-dimensional circular woven fabric is oriented multiaxially both in the in-plane and the out-of-plane directions so as to provide high torsional strength, shear strength and high modulus without delaminating. (See Col 2, lines 5-10) Bilisik further discloses the woven fabric preform for use in complex cross-sectional configured preforms for selected composite applications employing a structure with at least one preform (See Figs. 1-5) having at least one stressable reinforcing fiber layer (See Col 2, lines 6-11, wherein torsional and sheer recite stress) characterized in that:

- the reinforcing fibers extend radially in a layer. (See Fig. 1)

- the reinforcing fibers extend in a circular manner in a layer. (See Fig. 1)
- the reinforcing fibers extend involutely in a layer. (See Fig. 1)
- the reinforcing fibers extend in a layer extending from their central opening tangentially (See Fig. 1)
- consists of several layers, the layers being placed symmetrically or substantially symmetrically with respect to the central symmetrical plane of the preform in their fiber orientation. (See Fig. 1)
- the preform consists of at least two layers or plies, one of the layers or plies being built from radially placed reinforcing fibers and the remaining layer or ply of reinforcing fibers placed in a circular manner. (See Fig. 1)
- the preform has fibers of the same or essentially the same orientation in its outer surfaces or layers. (See Fig. 3, wherein the same layer 2 is on outer surfaces)

It would have been obvious to one of ordinary skill in the art at the time of the invention to arrange the reinforcing fibers in the preform of modified Krenkel with the tailored fiber orientation as taught by Bilisik, for the purpose of obtaining a woven preform of complex shape having improved torsional and shear properties.

14. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Krenkel et al (US 6,042,935) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) applied to claims

1-8, 10-12, 17-18, 20, and 25-29 above and further in view of Hect (US 6,365,257)

Regarding claim 9, modified Krenkel discloses all of the claim limitations as set forth above, in addition to disclosing a core body made of carbon fiber clusters which can be reused to considerably reduce the cost of a friction unit by the simple replacement of just the worn-out, abraded friction body. (See Col 2, lines 33-36, and Col 5, lines 13-16) Modified Krenkel teaches that the carbon fibers of the core body are stacked in individual layers one on top of the other or wound, and the orientation of the fibers in adjacent layers can be different, oriented or unoriented. (See Col 4, lines 43-46) Where Krenkel discloses the preform has reinforcing fibers in the form of roving strands or fiber bands. (Col 5, lines 13-16 wherein fiber clusters read on fiber bands and roving strands), the reference does not explicitly disclose the preform has rovings with thread counts which differ from one another.

Hect teaches carbon-carbon fiber composites intended for use in applications where severe shear stresses will be encountered, for example, by being subjected to circumferential stress. (See Col 1, lines 30-33). Hect also teaches that webs which are composed of random filaments rather than filament bundles or tow, take the form of thin felts and papers with very low bulk densities. (See Col 3, lines 48-52) Hect teaches that such highly randomized filaments, even after needlepunching, do not provide the strength advantages obtained generally when using dense, high fiber volume structures comprising aligned and

oriented continuous fiber. (See Col 3, lines 55-63) Hect also teaches a preform with reinforcement fibers that are disposed as chords of a circle at numerous angles and that remain as straight and continuous as possible across the preform to maximize reinforcement effectiveness. The obtained friction disc has nominally isotropic properties in the plane with a wide range of fiber orientation on the lamina level and throughout the overall composite. (See Col 4, lines 5-25) This preform can be easily modified to change tow (roving) size and number of tows used.

Additionally, Hect teaches that the method of needlepunching in making preforms having three-dimensional isotropic property characteristics will result in a high strength and densified fiber reinforced composite component (See Col 4, lines 6-8 and 64-67) characterized in that:

- the preform has rovings with thread counts which differ from one another. (See Col 12, lines 29-42, wherein filament bundles are rovings)

It would have been obvious to one of ordinary skill in the art at the time of the invention to arrange the reinforcing fibers in the preform of modified Krenkel with the fiber orientation as taught by Hect, for the purpose of obtaining a friction disc has nominally isotropic properties to maximize reinforcement effectiveness.

15. Claims 19 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krenkel et al (US 6,042,935) in view of Mattheij et al. (3D Reinforced

Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) applied above and further in view of Doucette et al. (US 5985405)

Regarding claims 19 and 23 modified Krenkel et al. discloses carbon fiber-reinforced, porous carbon bodies with the core body and friction body joined together by means of a bonding layer containing mostly silicon carbide which is then ceramicized and subjected to heat treatment. (See Col 3, lines 5-19) Modified Krenkel et al. further discloses a multiple-disk brake system having a friction body with a base layer (fleece layer). (See Fig. 2, ref. 5) Modified Krenkel et al. does not explicitly disclose the reinforcing fibers of the preform are stitched onto the base layer, or the layers of the preform are each stitched together with the base layer.

Doucette et al. discloses a 3-D reinforced composite that includes a high density fabric-based layer (See ablative layer Col 2, lines 14-23) stitched together with a fiber layer (insulative layer) using a temperature-resistant thread which extends through the plurality of layers. (See Col 1, lines 55-64) By increasing the fabric thickness with stitching rather than bonding by lamination (like that of modified Krenkel et al.) or otherwise fastened together to make a fabric stack, the thickness of the composite is increased and will provide sufficient means for holding the fabric layers together while under stress. (See Col 3, lines 5-16) Further, Doucette et al. discloses that the layers are stitched with a number of stitches per square inch of surface area sufficient to hold fabric layers together and to provide pathways, along the stitch, for the escape of

decomposition products that are generated upon exposure of the base (ablative) layer to high temperatures. (See Col 3, lines 19-24)

Additionally, Doucette et al. discloses the fiber composite component characterized in that:

- the reinforcing fibers of the preform are stitched onto a base layer based on carbon, aramide and/or ceramic fibers and/or a fleece. (See Col 3, lines 5-24, and 31-37, wherein the base layer is of carbon fabric)

- the layers or plies of the preform are each stitched together with the base layer. (See Fig. 1, refs. 12 and 14, wherein the fabric layers are lock stitched.)

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the stitching of the layers together of the preform as taught by Doucette et al. for the production of the brake disks of modified Krenkel in order to increase the thickness of the composite and provide sufficient means for holding the fabric layers together while under high stress and temperature more effectively than by lamination or other fastening methods known in the art.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AlTrev C. Sykes whose telephone number is 571-270-3162. The examiner can normally be reached on Monday-Thursday, 7:30AM-5PM EST, alt Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on 571-272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ACS
1/28/08

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 4145